

Black Ash Dieback in Northern Minnesota:

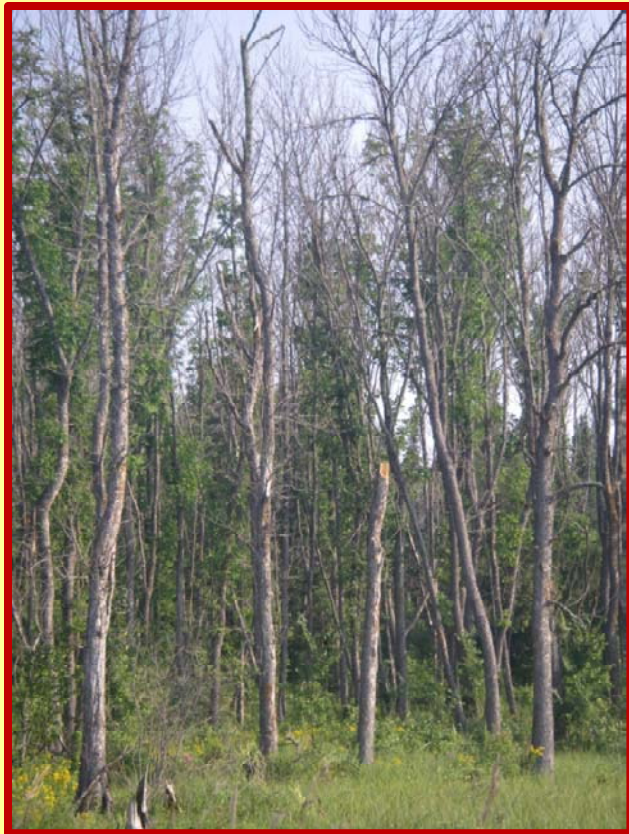
Will Emerald Ash Borer Really Make a Difference?

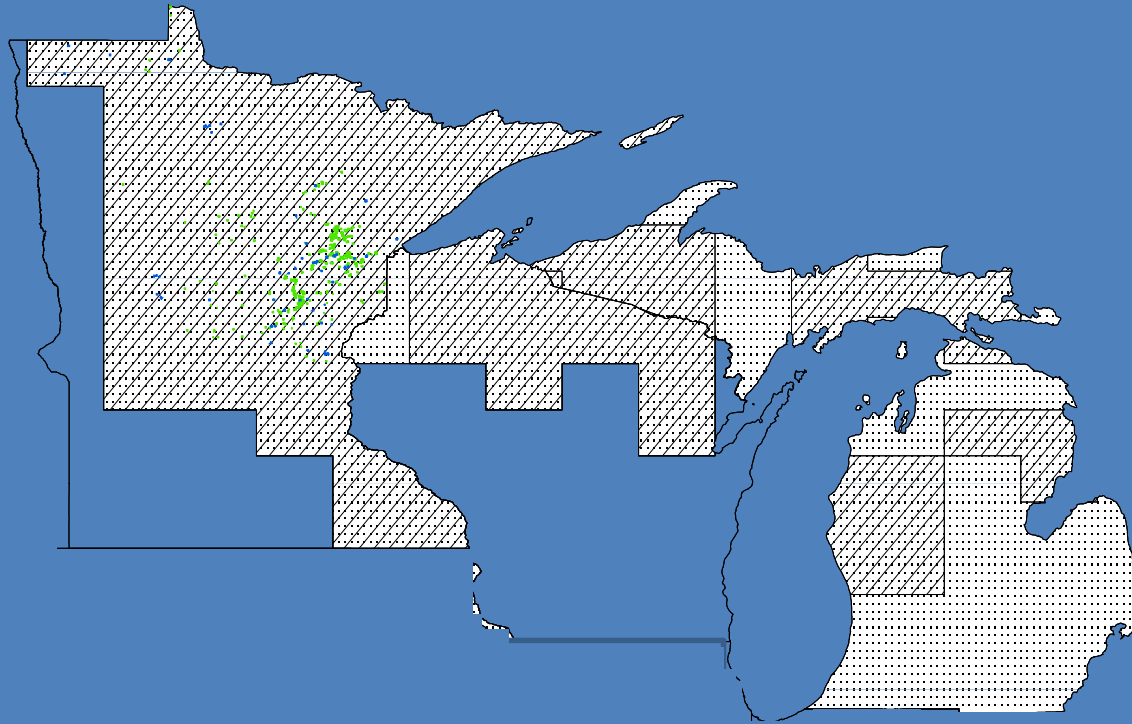
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**Extensive crown dieback
is a common sight in black
ash stands in
northcentral Minnesota**





Lakes States
Aerial sketch mapping of ash dieback and survey areas
2004 and 2005

Regional decline/dieback

Widespread dieback was noted throughout the state of Maine by 1993 (Trial and Devine, 1994)

BIA Tribal Lands CFI – Minnesota and Wisconsin: regional onset of decline appears 1988 and 1992

In Minnesota, dieback has occurred periodically over the last several decades: 27,000 ac (2004), 22,000 ac (2009)

Minnesota: mortality increased 18% between 1990 and 2003

Hypothesized causes

Dieback of *Fraxinus nigra* has an unknown disease etiology

Cohort senescence: populations are senescing due to old age in synchrony across the landscape

Drought stress: trees on wet sites have reduced access to water during spring drought; unable to fill new vessels prior to leaf expansion (Livingston and White 1997)

Moisture stress: sites are too wet, even for a wetland species (dieback more frequent on wetland site (FIA data); Ward et al. 2009).

Road impacts: dieback (FIA data) clustered near roads; changes in hydrology; deicing salt (Ward et al. 2009).

Our goal:

Better understand stand-scale dieback and its variability and relationship to potential causes

Before EAB impacts begin!

How variable is dieback across the region?

Is dieback related to wetland status and site moisture?

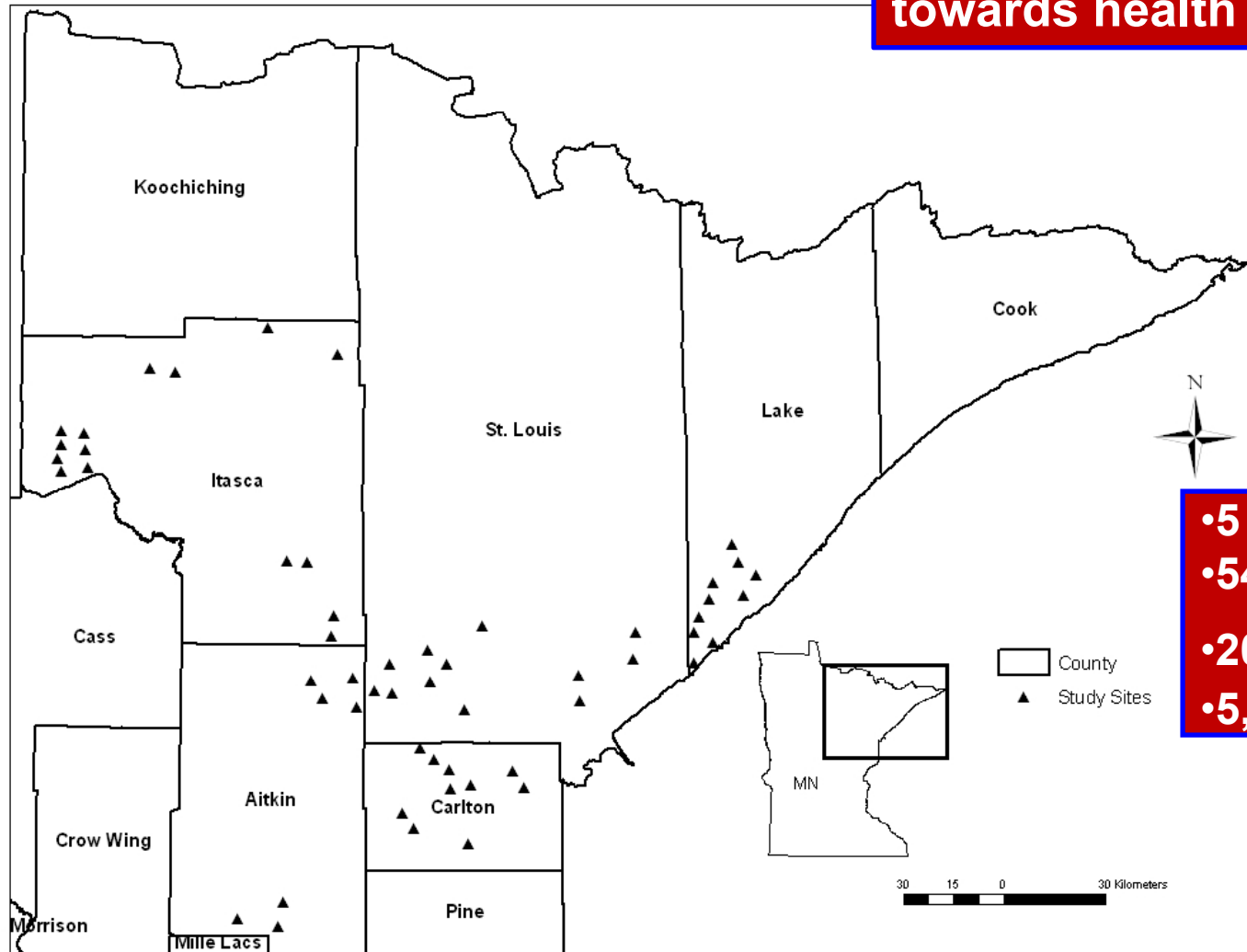
Is dieback related to tree age/size distributions in a stand?

Is dieback related to road proximity?

What is the potential successional trajectory of stands with ash loss?

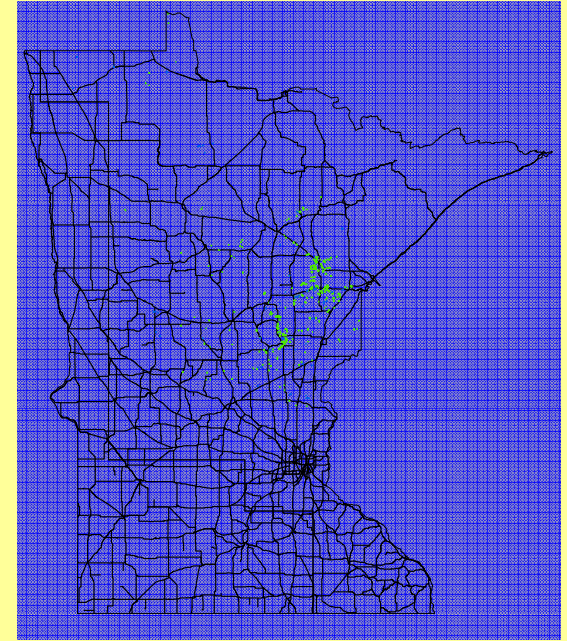
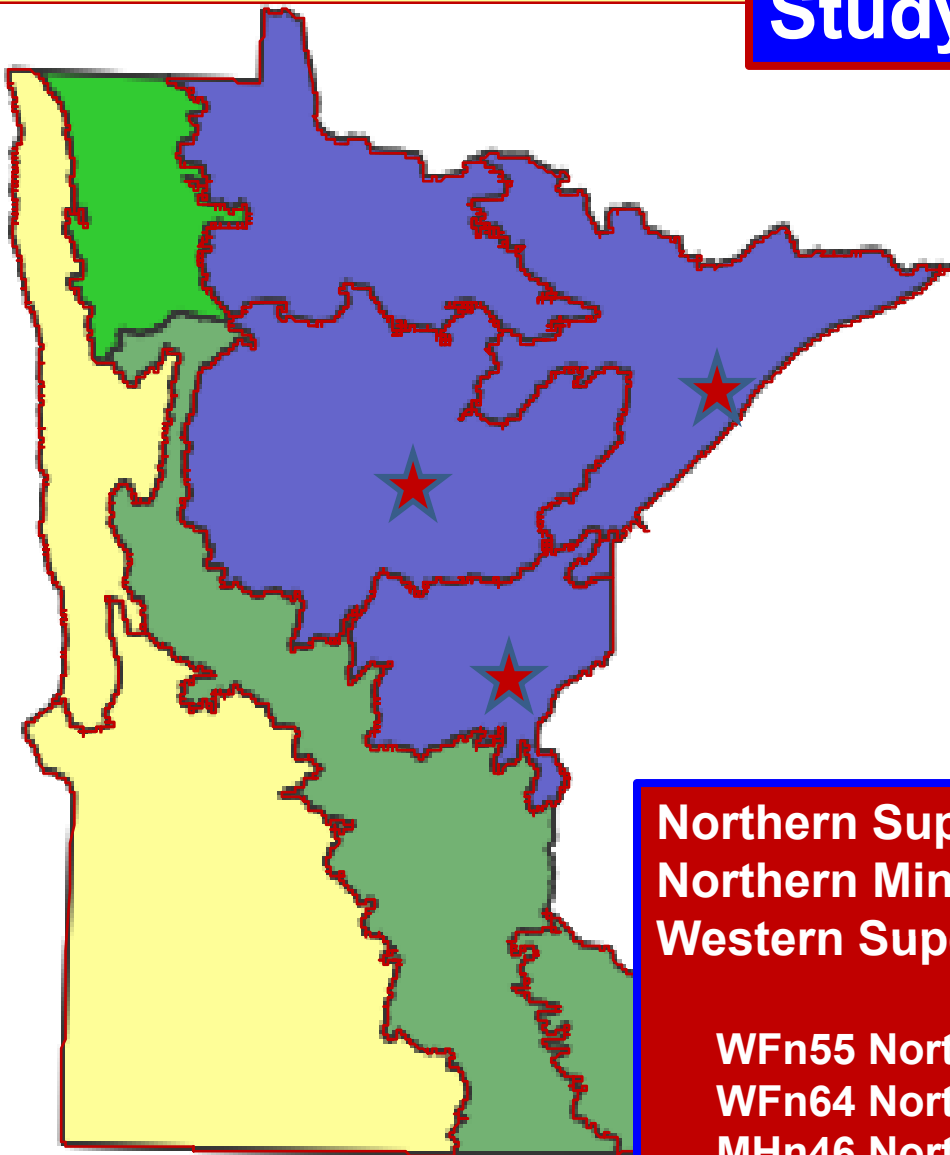
Study Area and Sites

Sites selected without bias towards health condition



- 5 counties
- 54 stands
- 205 1/20 ac plots
- 5,400 trees

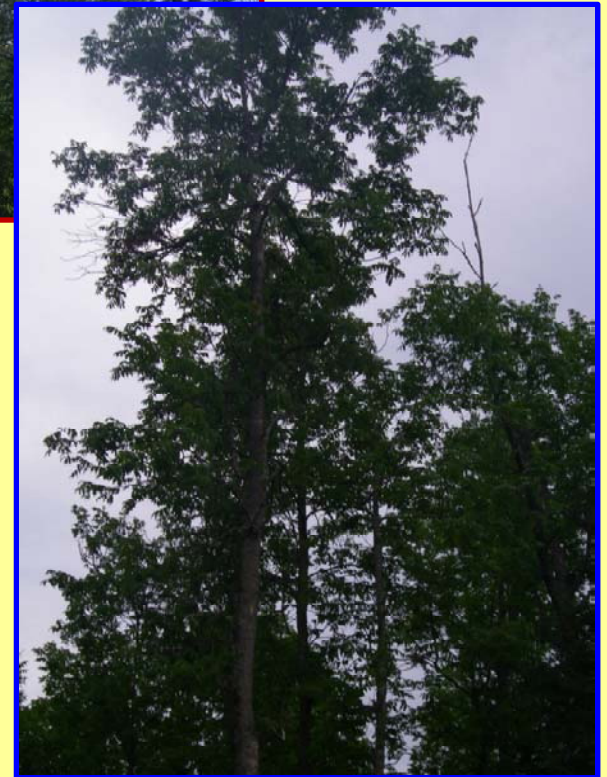
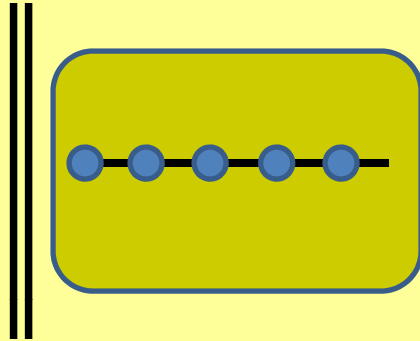
Study Area and Sites



Northern Superior Uplands
Northern Minnesota Drift and Lake Plains
Western Superior Uplands

WFn55 Northern Wet Ash Swamp
WFn64 Northern Very Wet Ash Swamp
MHn46 Northern Wet-Mesic Hardwood Forest
MHc47 Central Wet-Mesic Hardwood Forest

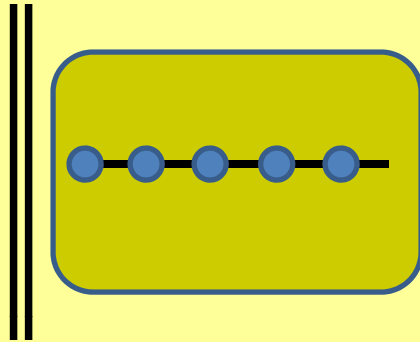
Field Sampling



Tree/Crown Condition:

- Alive or Dead
- If Alive, Crown Dieback or Not
 - loss of apical dominance
 - epicormic branching
 - dead branches

Field Sampling



Site Variables:

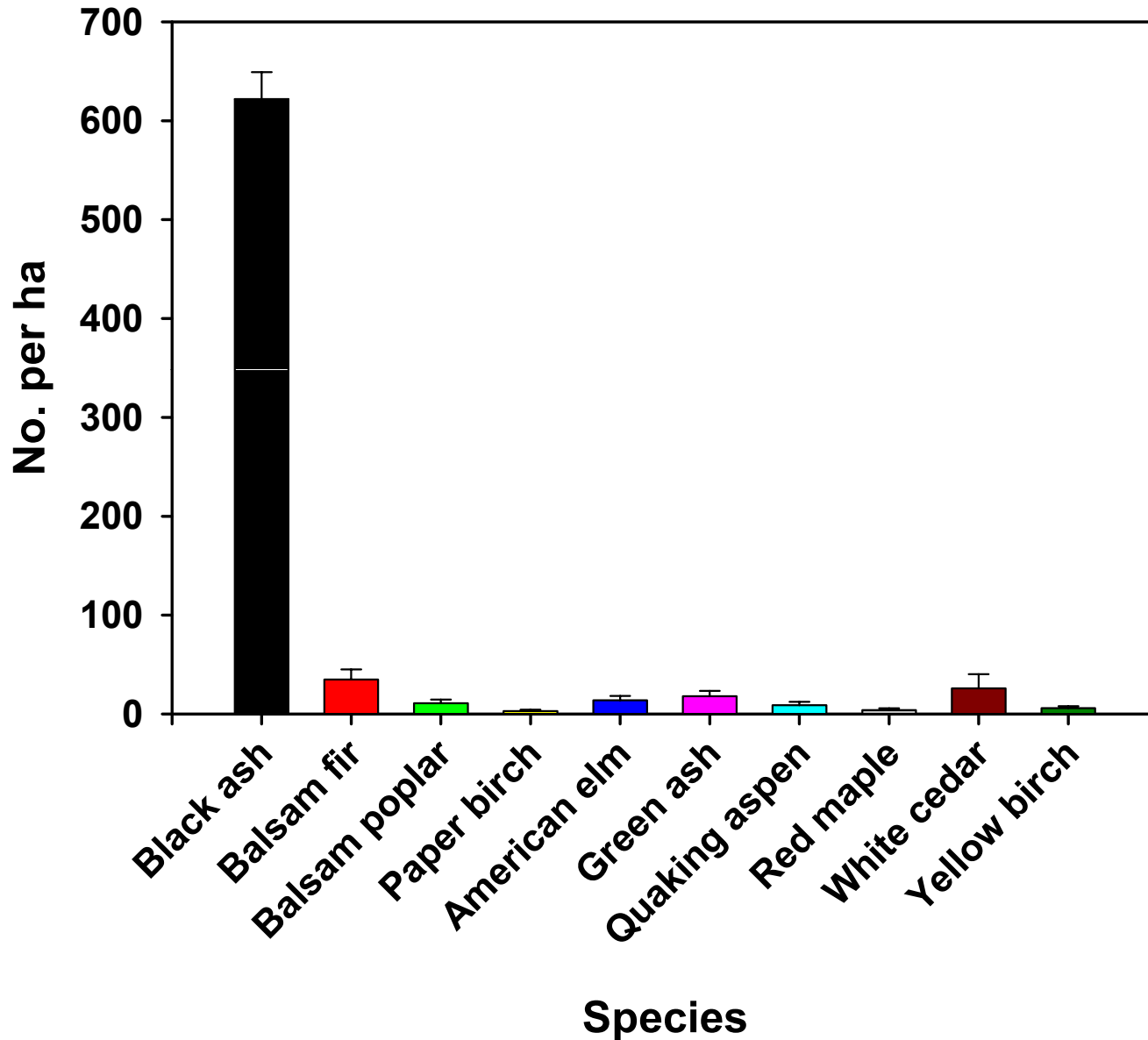
- NWI system (upland, wetland)
- Wetness index
- Depth to a perching layer

Vegetation:

- Woody vegetation
- Shrub vegetation
- Tree ages



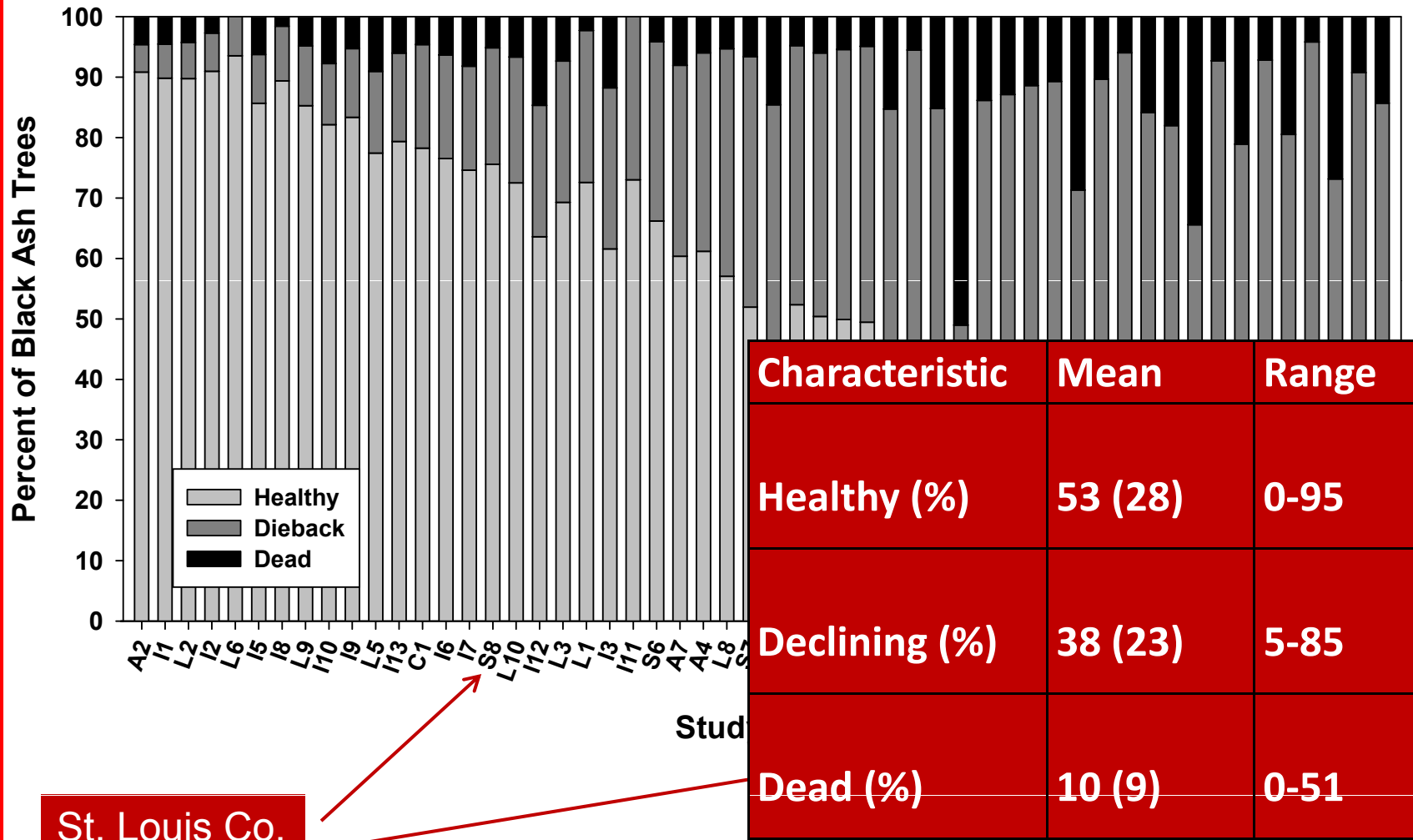
Overstory Composition



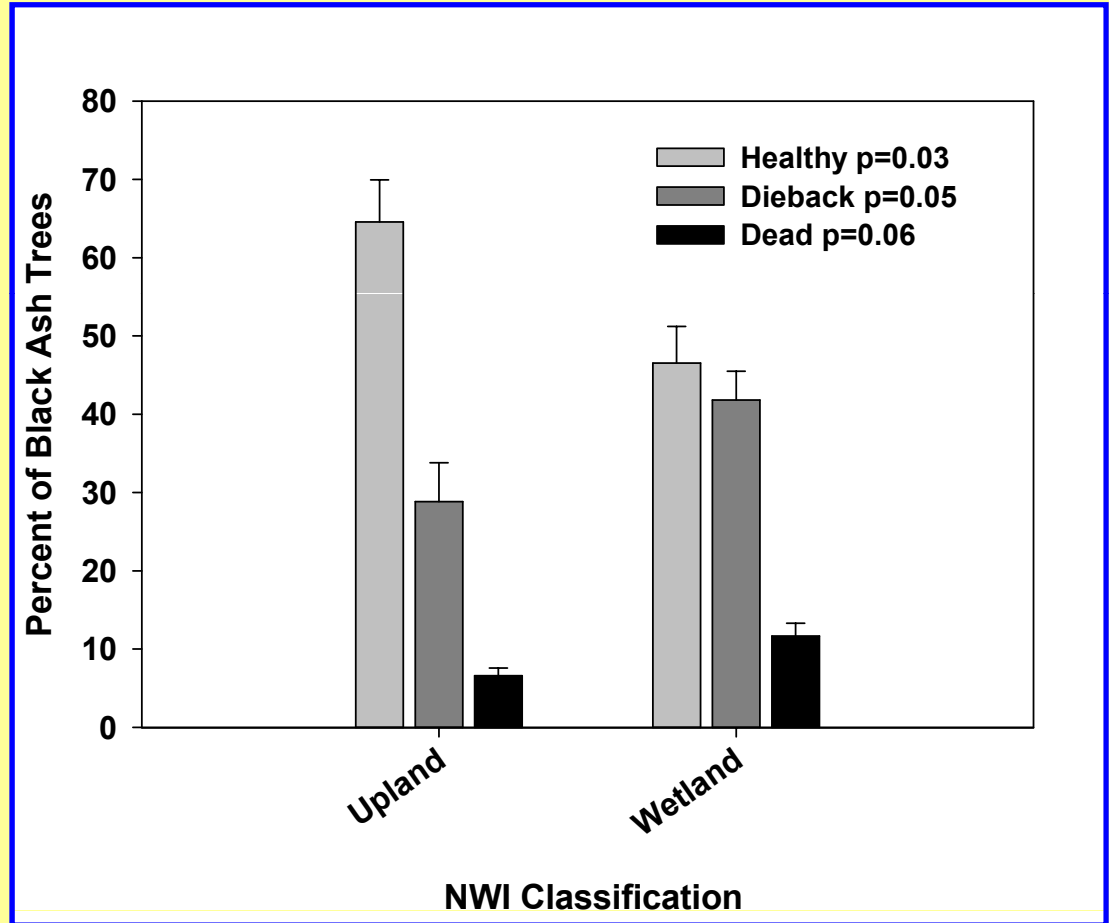
**How variable is
dieback across the
region?**



How variable is dieback across the region?



Is dieback related to wetland status and site moisture?



Is dieback related to wetland status and site moisture?

Depth to a Restrictive Layer

Shallow → Deep

Thin sponge

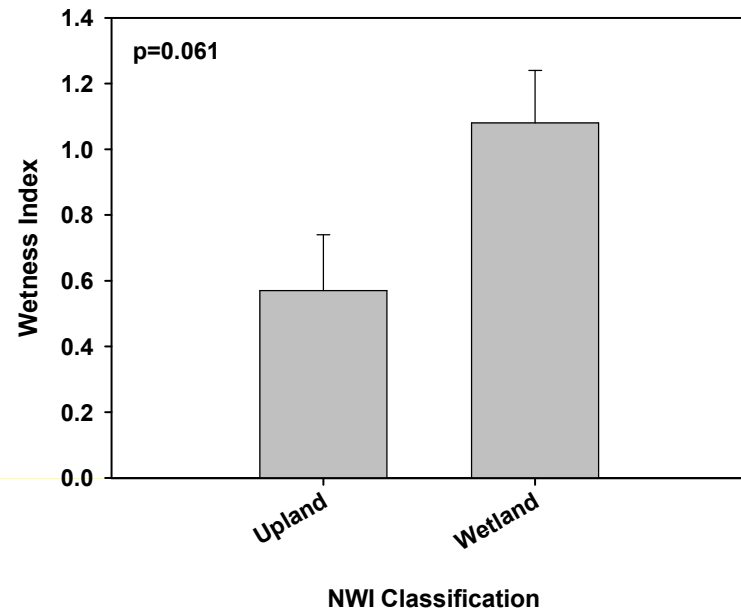
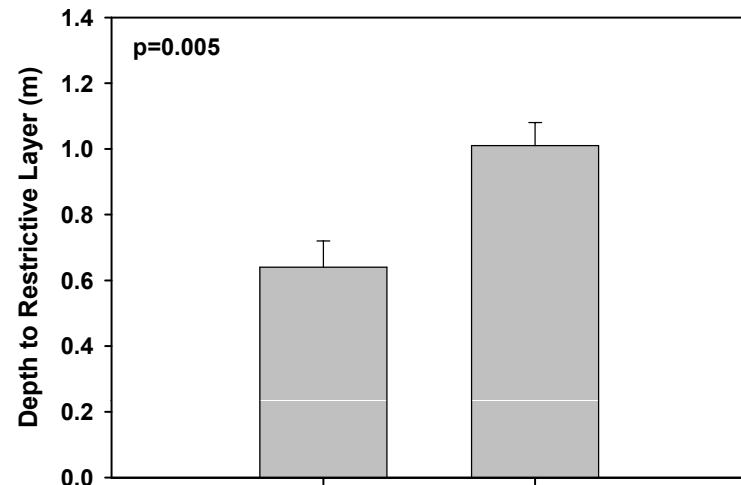
Thick sponge

Wetness Index

0 → 3

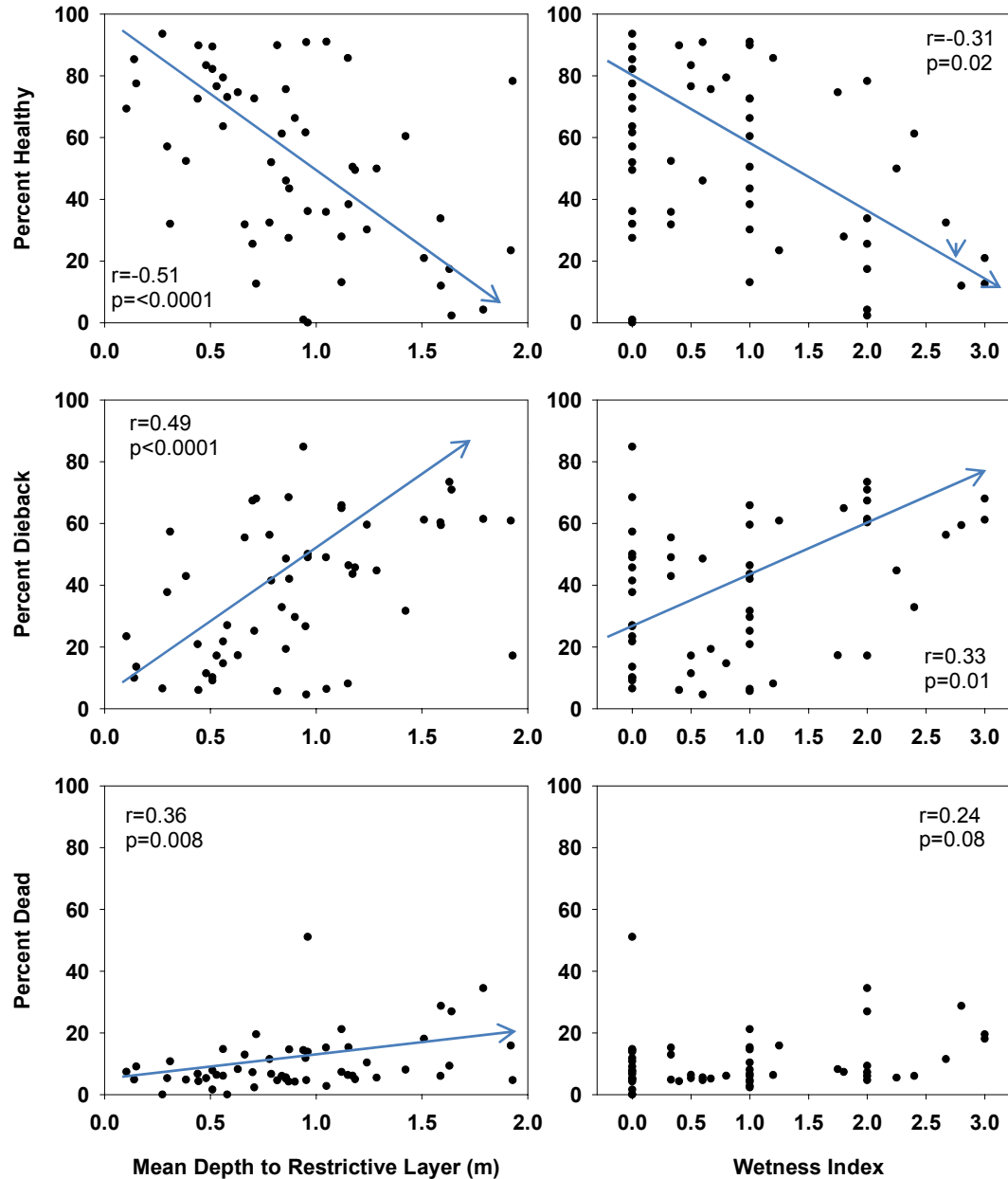
No
standing
water

Ponded
water
throughout



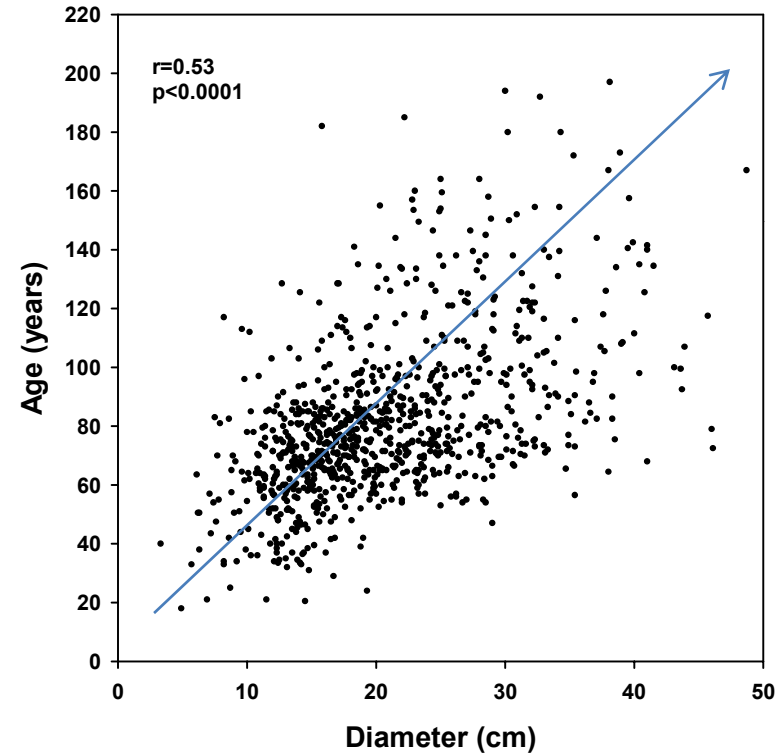
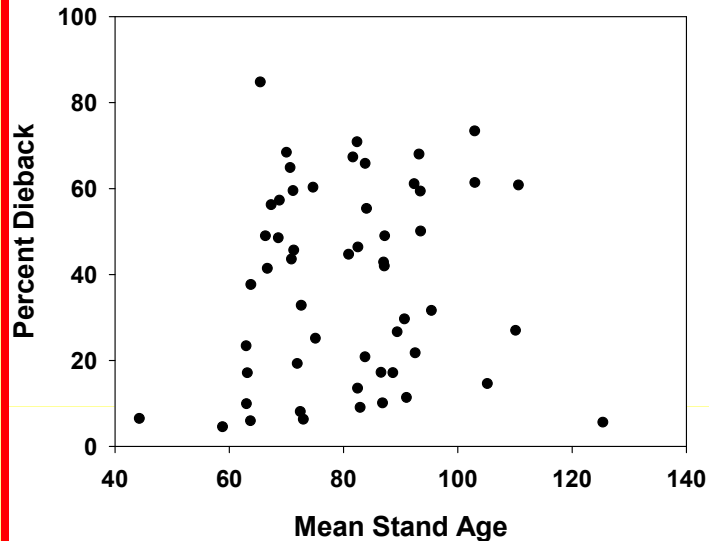
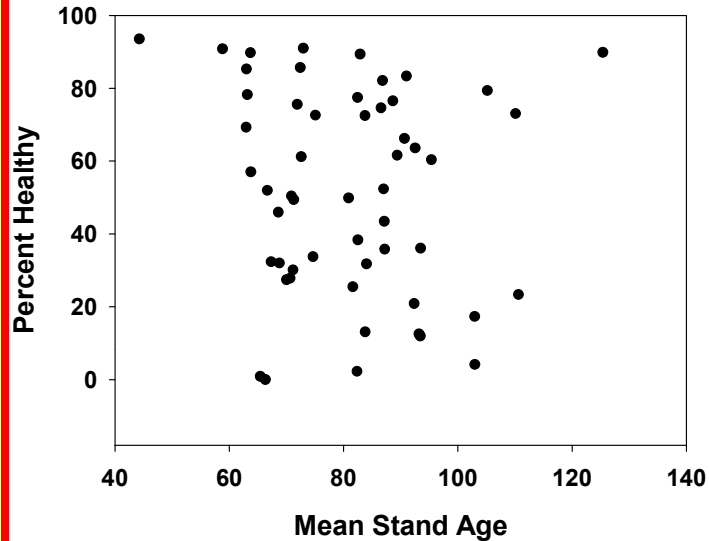
**Dieback
and
moisture**

**Wetter
sites =
more
dieback**

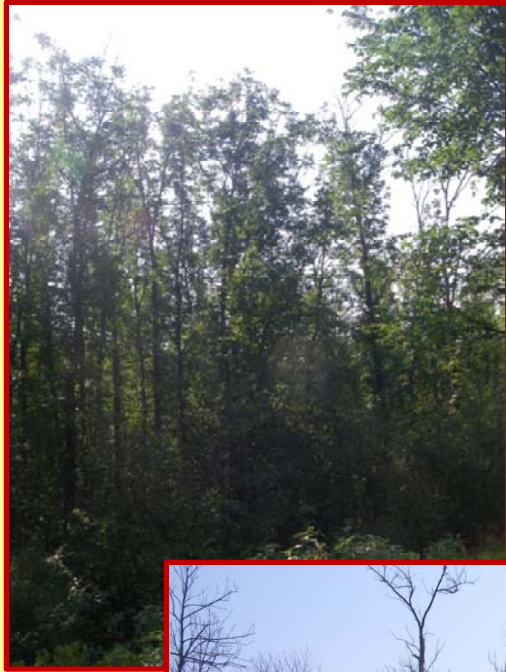


Is dieback related to tree age/size distributions?

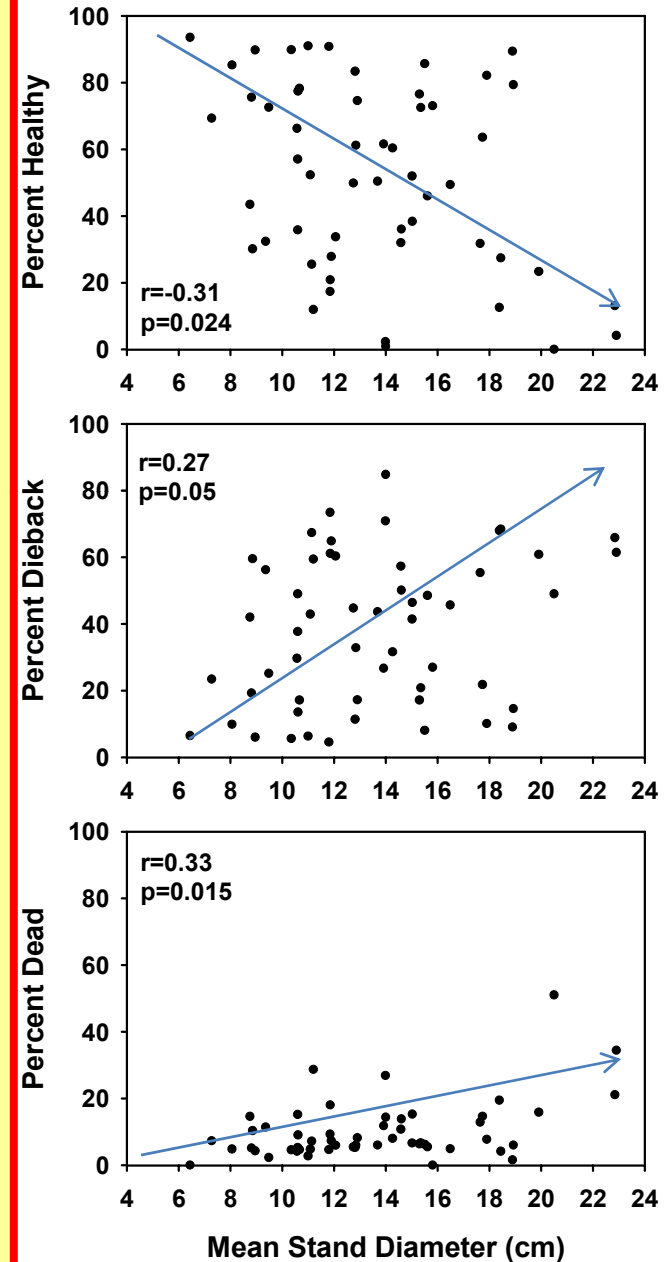
Cohort Senescence?



Is dieback related to tree age/size distributions?



Larger diameter stands have more dieback



Is dieback related to road proximity?

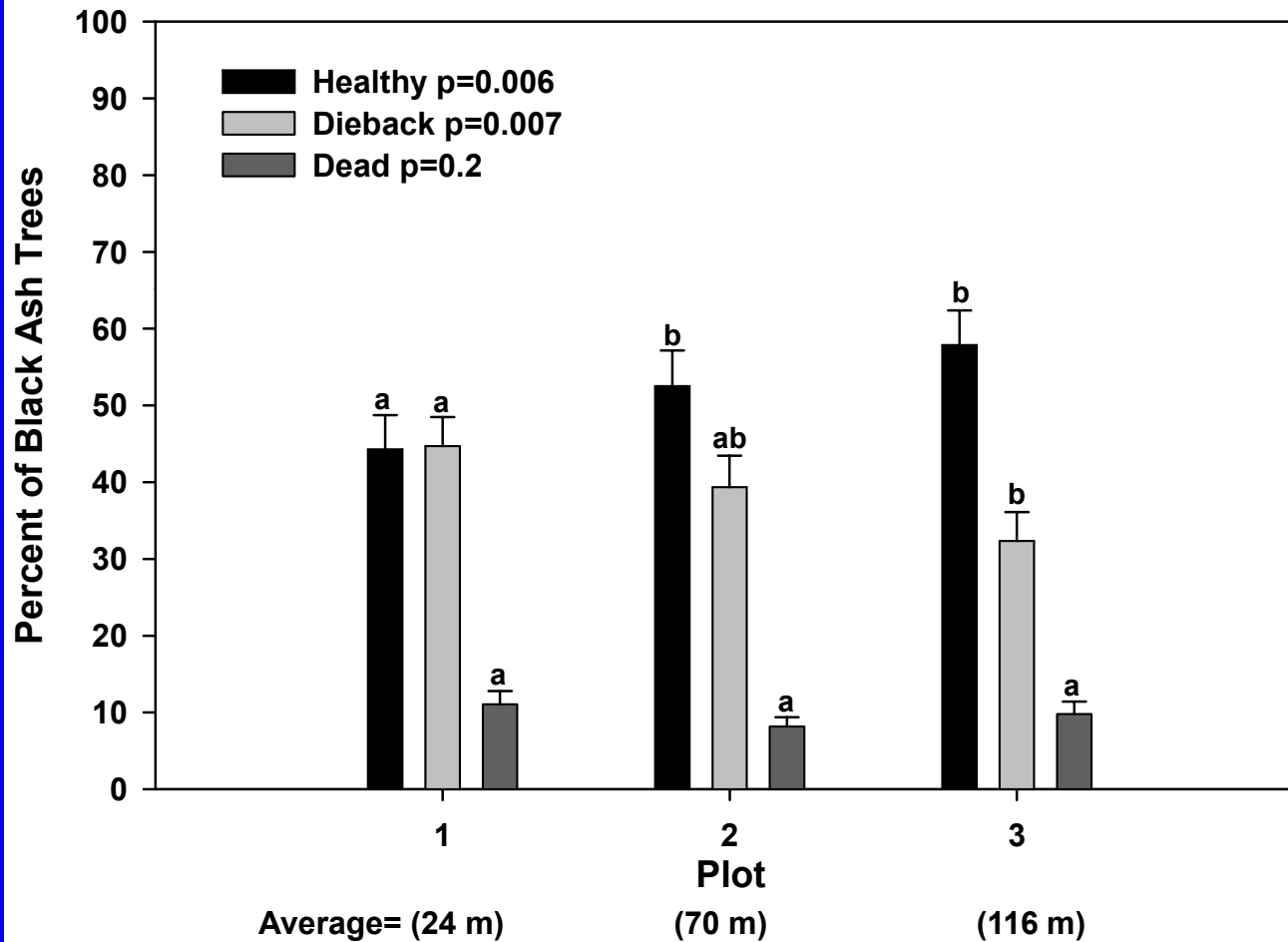
- altered hydrology; -deicing salt toxicity



Fraxinus nigra is rated as moderately tolerant of soil salt and salt spray by some (Ritchie, 1996) to intolerant by others (USDA NRCS Plants Database).

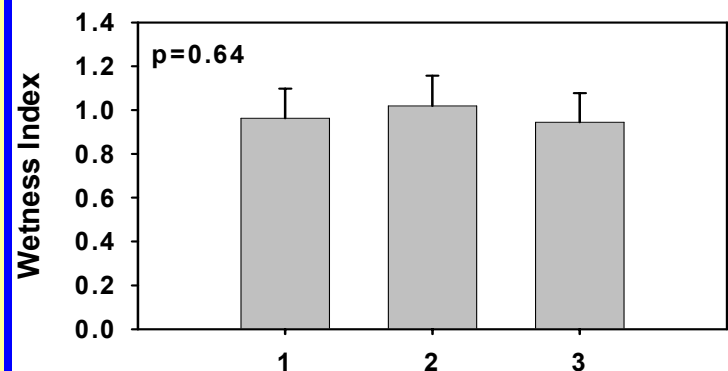
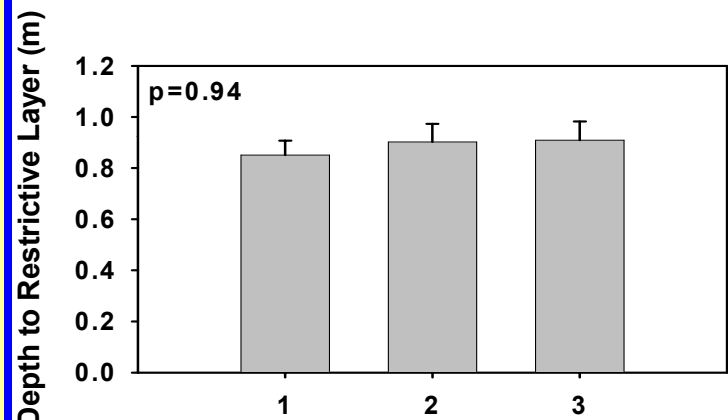
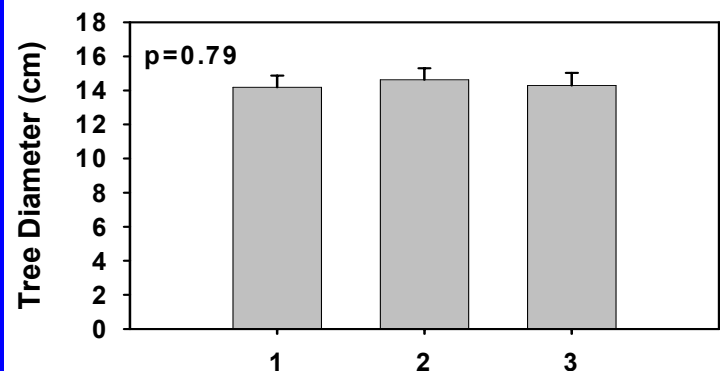


Is dieback related to road proximity?



**Dieback and
road proximity**

**Other factors
unchanging with
distance**



Plot
— Increasing Distance From Road →

Summary

- 1) High incidences of crown dieback, but dieback was variable across the region
- 2) More dieback occurred on jurisdictional wetlands and locally wetter conditions

Stress related to excessive flooding or drought in shallow rooted trees on wet sites?

- 3) Dieback positively correlated with stand diameter and diameters increased with age

Cohort senescence?

- 4) Dieback occurred with higher frequency nearer to roads

-Hydrological alterations or toxicity from road deicing salt

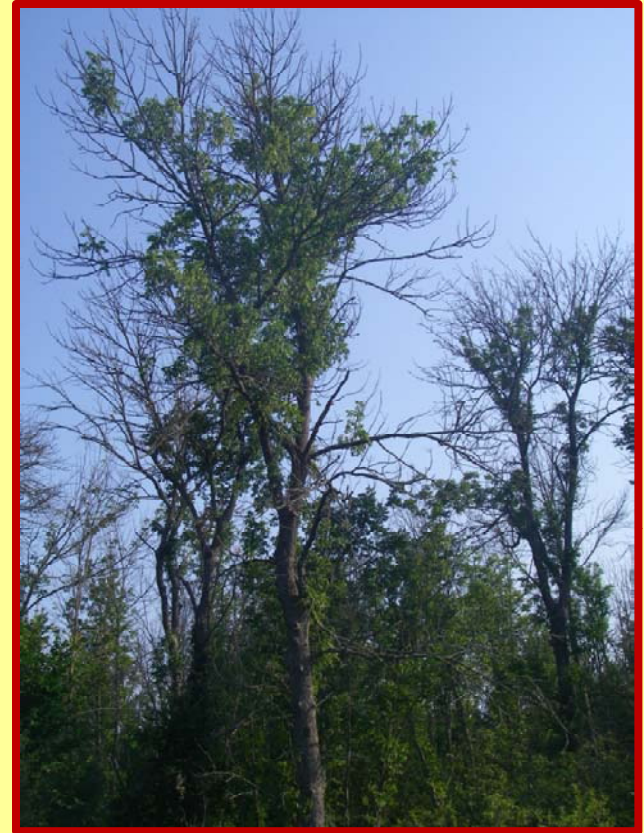
-Perception that dieback is more severe regionally than our study suggests?

Results indicate that healthiest stands are likely to be younger, on drier sites, and farther from roads, compared to stands with significant amounts of crown dieback

A Caution!

Dieback vs Decline

Characteristic	Mean	Range
Healthy (%)	53 (28)	0-95
Declining (%)	38 (23)	5-85
Dead (%)	10 (9)	0-51



- Is black ash declining or experiencing episodic periods of environmental stress and responding through dieback?
- Is the relatively low tree mortality and presence of epicormic branches and crown re-growth indications of tree recovery?

Potential successional trends in declining? stands

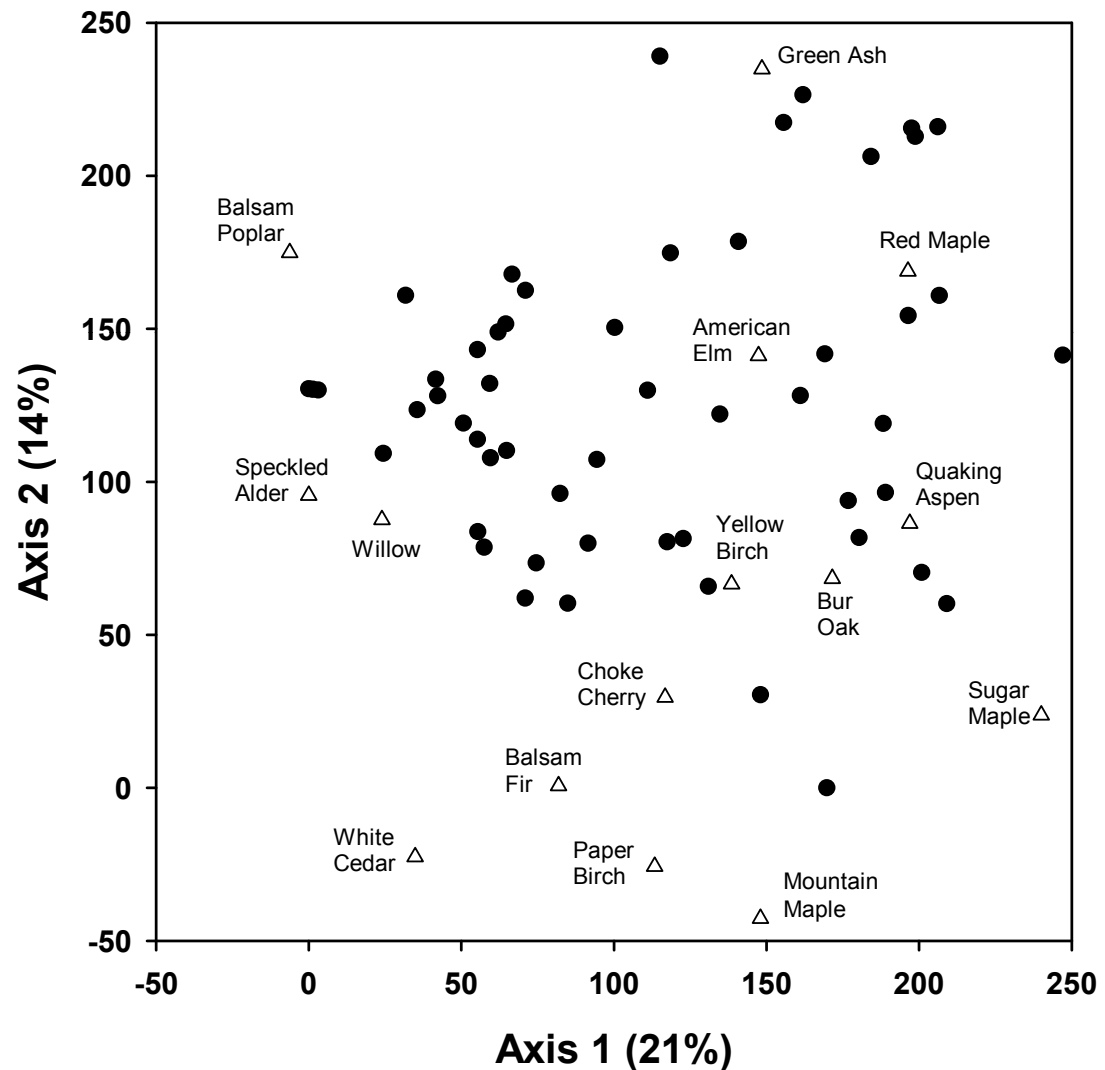


- Sapling layer
- Advanced regeneration
- Seedling/shrub layer



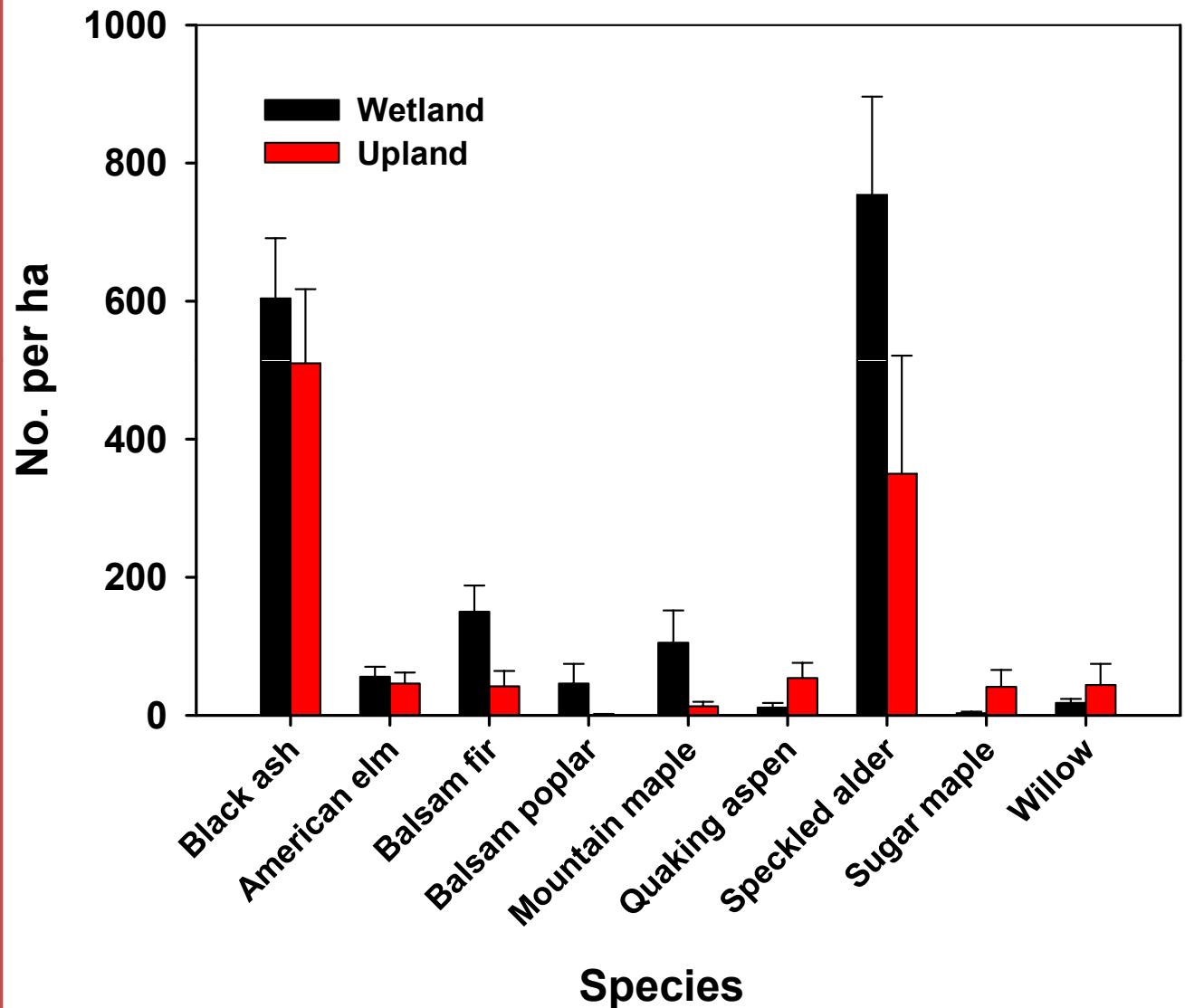
Sapling layer composition

**Diverse and
variable,
however...**

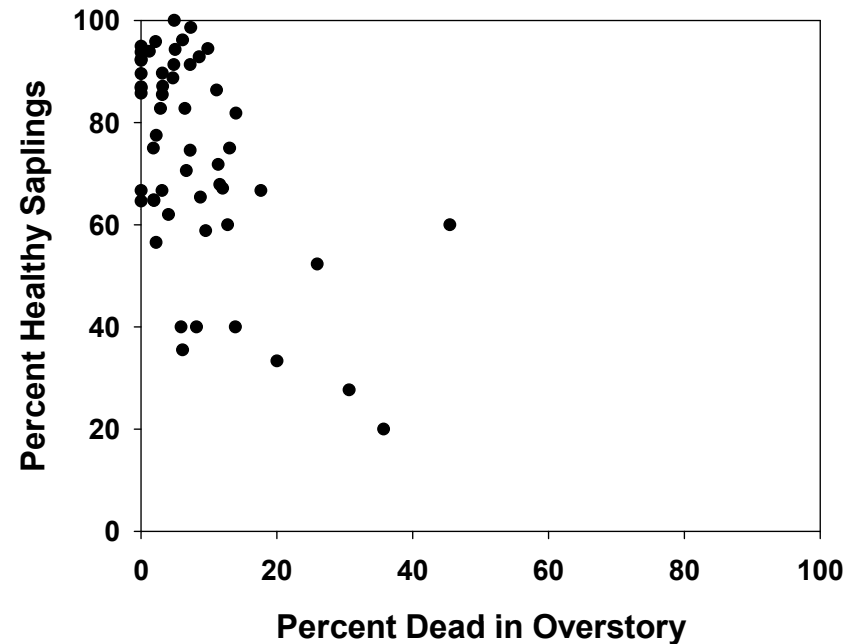
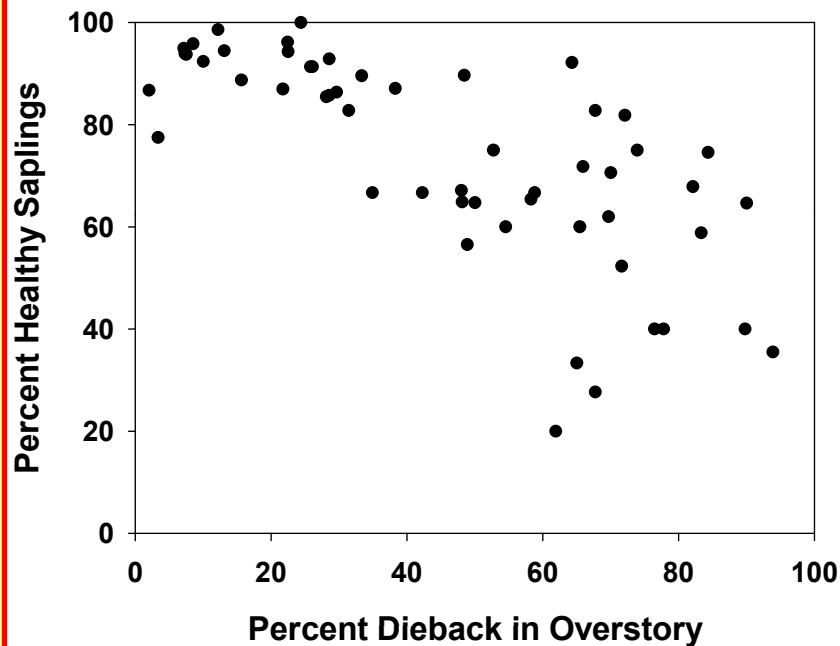


**Mostly
black ash
and alder**

**Sapling
layer does
not contain
abundant
stems of
canopy
replacement
species**



Health of black ash saplings?

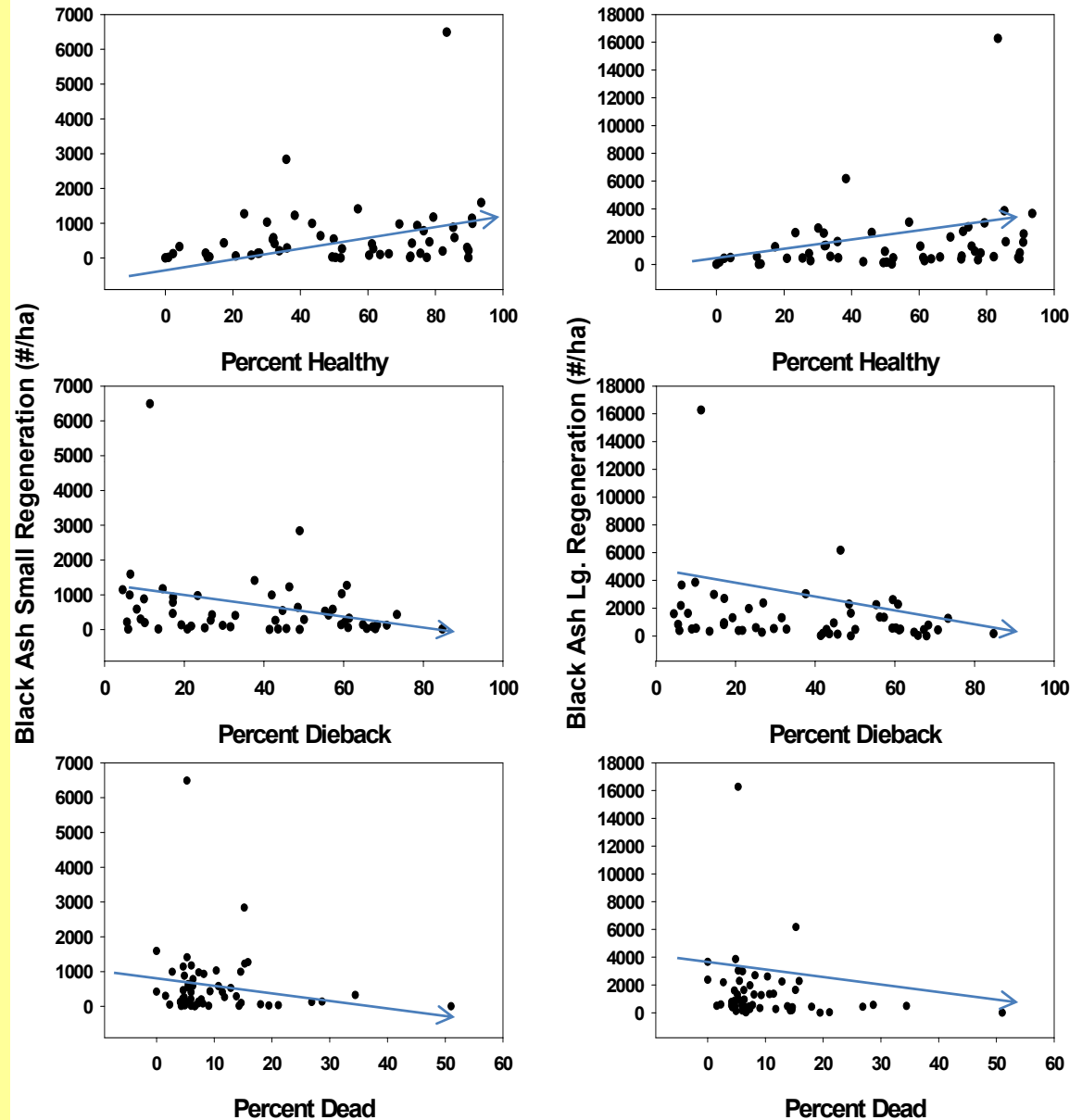


Sites with dieback are not replacing themselves with healthy saplings

**Black ash
advanced
regeneration**

**Less in less
healthy stands**

**No self-
replacement?**



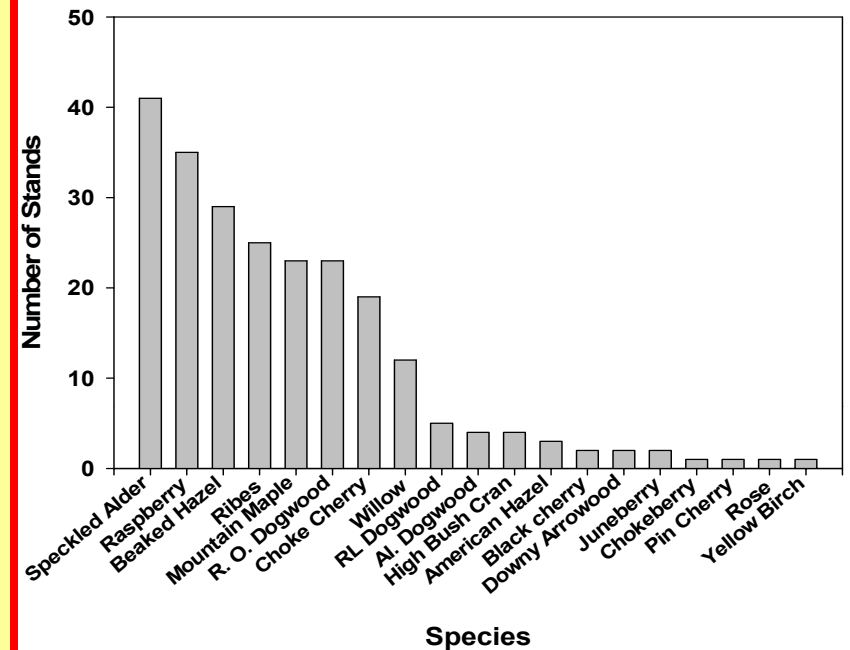
Overstory Condition

Sub-sapling woody vegetation (other than black ash)

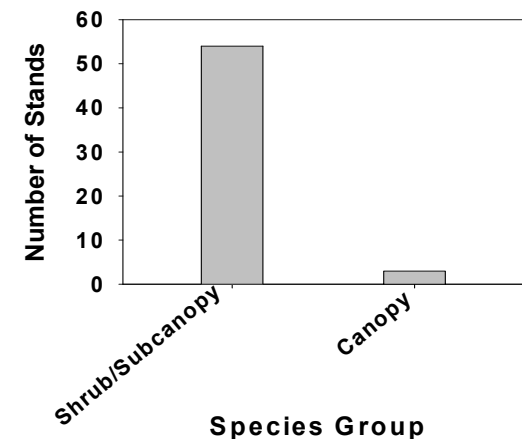
Dominated by sub-canopy & shrub spp.

- speckled alder
- raspberry
- hazel
- Ribes
- mountain maple
- dogwood

Only 3 of 54 stands contained canopy tree species at high enough abundance to be noted



Take home: there are no tree species other than black ash that appear to be regenerating in abundance in black ash stands & ash regeneration is not abundant in stands with dieback



Black Ash Dieback in Northern Minnesota:

Will Emerald Ash Borer Really Make a Difference?

- Yes, because currently healthy stands exist
- Yes, if dieback does not result in decline
(i.e., currently unhealthy stands may recover)
- Yes, will hasten canopy loss in systems with regeneration & successional replacement bottlenecks



We thank the following forestry and land departments for logistic support and access to study sites:

- Aitkin, Carlton, Itasca, Lake, and St. Louis Counties**
- The Fond Du Lac Band of Lake Superior Chippewa**
- The Minnesota Department of Natural Resources**
- The Chippewa National Forest**
- The Cloquet Forestry Center**

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